

## NEW PUBLICATIONS.

WALLACE'S DISTRIBUTION OF ANIMALS.  
THE GEOGRAPHICAL DISTRIBUTION OF ANIMALS.  
By ALFRED RUSSEL WALLACE. 2 vols. 8vo. pp.  
562, 667. Harper & Brothers.

In treating the subject to which these volumes are devoted, Mr. Wallace starts from the principle, which he affirms is now conceded by naturalists, that the modification of animal forms takes place very slowly, so that the historical period of three or four thousand years has hardly produced any perceptible change in a single species. The old notion that every species was specially created as it now exists, at a particular time and in a particular spot, as maintained, is abandoned as opposed to many striking facts, and unsupported by any evidence. But the modification of animal forms took place very slowly, so that the historical period of three or four thousand years has hardly produced any perceptible change in a single species. The changes in the forms of animals appear to have accompanied the changes of physical geography, of climate, or of vegetation. But as the minor features of the earth's surface, together with the structure and habits of all living things are everywhere slowly changing, while the great features of the earth—the continents, and oceans, and loftiest mountain ranges,—only change with extreme slowness and after very long intervals, it is evident the present distribution of animals is the final product of all these revolutions in organic and inorganic nature. The greatest differences in the productions of any part of the globe must depend on isolation by the most effectual barriers.

The natural tendency of animals is to roam in every direction in quest of food. But in doing this they meet with many obstacles. Rocks and mountains have to be climbed, rivers and marshes to be crossed, deserts or forests to be traversed, while narrow straits or wider arms of the sea separate islands from the main land or continents from each other. We must consider the facilities of different classes of animals for overcoming these obstacles, and what kinds of barriers are most effectual in checking their progress. Many of the largest mammals are able to roam over whole continents. The elephant, for example, is equally at home on plains and mountains. It climbs to the rocky summit of Adam's Peak in Ceylon, which is almost too steep for man to ascend. It traverses rivers and forces its way through the densest jungles with surprising ease. The tiger, the rhinoceros, and the lion have equal powers of dispersal. Wherever there is land and food there are no limits to their range. Other animals are more limited in their migrations. The apes, lemurs, and many monkeys can never pass far beyond the limits of the forest vegetation. One species of swallow and thrush are known to increase at the expense of their blood relatives. Rats, carried over the world by commerce, constantly extirpate other species of rats. The imported honey-bee is rapidly killing off the native stingless bee of Australia. From facts like these, which abound in the writings of Darwin, Mr. Wallace concludes that the several varieties both of animals and vegetables which inhabit any extensive region are so interrelated with each other that the increase, diminution, or extermination of one may so affect the whole as to require centuries of fluctuation before the equilibrium is restored. The subject is too vast for human investigation. No research can fully explore its mysterious depths. We can only trace out imperfectly some of the larger changes in physical geography that have occurred during the ages immediately preceding our own, and to estimate their probable effect on animal distribution, while we may thus be enabled to determine the birthplace and subsequent migrations of the more important genera and families, and to form some conception of the grand series of co-ordinate changes in the earth and its inhabitants, the results of which are now to be seen in the forms and distribution of existing animals.

In the treatment of his grand and complicated theme, Mr. Wallace evinces a power of arrangement and organization without which the reader would be lost in a confused mass of inexplicable details.

The subject lies before his comprehensive glance in the lucid order of a geographical map, and in spite of the immense range of facts which he is called to consider, he never loses sight of the central principles in which he finds alike the guide of his researches and the key to his problems. Abstaining from the questions presented in the lofty heights of transcendental anatomy, or the bewildering maze of modern classification, he confines himself to the facts which he has discovered and the inferences which they authorize after a profound course of investigation and study. The original illustrations which accompany the work are of singular value, and will not fail to command the special attention of the reader. A series of twenty plates, in particular, which represent the physical aspect and the peculiar zoological character of certain well-marked regions, afford most instructive lesson in natural history. Such species as actually occur together in nature, and belong to groups that are characteristic of the country whose zoology they illustrate, are associated in the pictures which will themselves serve to convey a notion of the varied types in their true geographical relations. The total outcome of the splendid work, to intelligent readers, may be expressed in the language of the author, as "an increased appreciation of the beauty and the harmony of nature, and a fuller comprehension of the complex relation and mutual interdependence of the mean height of the land as compared with the mean depth of the water." The son-spassing is very dangerous to many birds. Quails cross in immense flocks, and great numbers are drowned at sea whenever the weather is unfavorable. Aquatic birds follow the routes of great rivers and lakes, and the shores of the sea. One great body reaches Central Europe by way of the Danube from the shores of the Black Sea, another ascends the Rhone Valley from the Gulf of Lyons.

The distribution of animals as affected by the conditions of the earth's surface is the subject of a singularly interesting chapter, showing the author's remarkable power of minute observation, and equally remarkable habit of reporting facts with precision and accuracy. Two important features of the earth's surface, says Mr. Wallace, are to be considered in their bearing on this point. First, the large proportion of water to land, as indicating the vast extent of ocean by which many of the continents and islands are separated from one another. Second, the smallness of the mean height of the land as compared with the mean depth of the water. The mean height of the land surface, it is computed, does not exceed a thousand feet; while the ocean bed not only descends deeper than the tops of the highest mountains rise above its surface, but these profound depths correspond to the mountain ranges, so that its mean depth, as nearly as can be ascertained, is twelve thousand feet. It is therefore highly probable that among the continual changes of land and sea, the amount of land surface has often been much less than it is now. It is, moreover, probable that large masses of land have been more isolated from the ocean than they are at present, just as North America would be if North America were to sink beneath the ocean, or as Australia would become if the Malay Archipelago were submerged. We must also bear in mind that the shallow parts of the ocean are almost always in the vicinity of land, and that a degree of elevation which would make little difference in the bed of the ocean would raise up extensive tracts of dry land in the vicinity of the land.

These principles illustrate two great facts in the distribution of animals, namely, the restriction of peculiar forms to areas not at present isolated, and the occurrence of allied forms in lands situated on opposite shores of the great oceans. Thus it has been discovered that a portion of the Sahara south of Algeria and Morocco was under water at no very distant date. Over much of this area, accordingly, we find numerous sea-shells, identical with those now living in the Mediterranean. These shells occur twenty feet deep in the sand. Frequent hills of salt also show the disappearance of a large body of salt water. A new fish has been discovered in a salt lake nearly 300 miles inland which has since been found to inhabit the Gulf of Guinea. In like manner, an instance of subsidence in the area of the Mediterranean is presented in the islands of Sicily and Malta which are connected with Africa by a submerged bank from 300 to 1,200 feet below the surface, while the depth of the Mediterranean, both to the east and west, is enormous, in some parts more than 13,000 feet. In cases of subsidence, accordingly, as was natural to expect, remains of elephants and hippopotamuses have been found, indicating that when North Africa was separated by a broad arm of the sea from the rest of the continent, it was probably connected with Europe.

The indirect influence of physical changes on the distribution of animals is doubtless no less impor-

tant than the direct action already referred to. Every change becomes the center of a wide circle of effects. The different members of the organic world are so bound together by complex relations that any one change usually involves many other changes. We know little, it is true, of the way in which our animal or plant is bound up with others; but we do know that groups the most apparently disconnected are often entirely dependent on other groups. Thus the introduction of goats into St. Helena destroyed a whole flora of forest trees. This was the sentence of death on all the insects, mollusca, and perhaps, birds, which found their living on the trees. Swine, which ran wild in Mauritius exterminated the dodo. The same animal is the most mortal foe of venomous serpents. In many districts, the browsing of cattle will prevent the growth of trees. With the trees, an end is put to the insects which depend upon the trees, to the birds which feed upon the insects, and to the small mammals which live upon the fruits, seeds, leaves, or roots. Insects, moreover, have the most wonderful influence on the range of mammals. In Paraguay a species of fly destroys new-born cattle and horses. Hence neither of these animals runs wild in that country, although they abound in the adjacent regions. This leads to a great difference in the vegetation of Paraguay, and through that to a difference in its insects, birds, reptiles, and wild mammals. The extinction of this fly would change the whole face of the country. So in South Africa, in the districts infested by the tsetse fly, no horses, dogs, or cattle can live. Yet it has no effect on asses, zebras, or antelopes. Mr. Darwin's often quoted case of the cat and dove affords an apt illustration of the point in question. It is known that in England both red clover and wild heartsease are fertilized only by the visits of humble-bees. But humble-bees are largely kept down by field-mice which destroy their combs and nests. Field-mice in their turn are kept down by cats. If there were no cats there would be no red clover or wild heartsease. For in that case there would be no check on the field-mice, which would multiply so abundantly as to destroy all the humble-bees. There would then be nothing to fertilize the red clover and heartsease, and the two plants would produce no seed and become extinct. It has also been shown that one species often exterminates another closely allied species. One species of swallow and thrush are known to increase at the expense of their blood relatives. Rats, carried over the world by commerce, constantly extirpate other species of rats. The imported honey-bee is rapidly killing off the native stingless bee of Australia. From facts like these, which abound in the writings of Darwin, Mr. Wallace concludes that the several varieties both of animals and vegetables which inhabit any extensive region are so interrelated with each other that the increase, diminution, or extermination of one may so affect the whole as to require centuries of fluctuation before the equilibrium is restored. The subject is too vast for human investigation. No research can fully explore its mysterious depths. We can only trace out imperfectly some of the larger changes in physical geography that have occurred during the ages immediately preceding our own, and to estimate their probable effect on animal distribution, while we may thus be enabled to determine the birthplace and subsequent migrations of the more important genera and families, and to form some conception of the grand series of co-ordinate changes in the earth and its inhabitants, the results of which are now to be seen in the forms and distribution of existing animals.

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